4. HARVEST IMPACTS TO SUMMER CHUM SALMON

4.1. Introduction

This section summarizes the multitude of work and effort that is ongoing, by the co-managers involving the harvest management of summer chum salmon. Most of this section will be drawn from the Summer Chum Salmon Conservation Initiative (SCSCI) (Washington Department of Fish & Wildlife and Point No Point Treaty Tribes 2000) and subsequent supplemental reports of the SCSCI (WDFW and PNPTT 2003). Section 4 also describes harvest interactions with aspects of habitat conditions, and their implications, as currently understood, for summer chum salmon recovery. The SCSCI and supplemental reports can be found at the WDFW web site: http://wdfw.wa.gov/fish/chum/chum.htm.

WDFW and PNPTT (2000) provides both short and long-term goals to guide the harvest management regimes for summer chum salmon. Those goals are, "The short-term goal of the harvest strategies outlined in this section is to protect the summer chum populations within Hood Canal and Eastern Strait of Juan de Fuca (HC-SJF) from further decline by minimizing the effect of harvest as a major factor to that decline. The long-term goal of these strategies is to assist in the restoration and maintenance of self-sustaining summer chum populations throughout the Hood Canal/Strait of Juan de Fuca while maintaining harvest opportunities on commingled salmon of other species."

Harvest management regimes are being designed to limit mortality from fishing to a rate that allows the vast majority of summer chum salmon to return to their natal spawning grounds. To achieve these goals, the co-managers instituted harvest management regimes while the SCSCI was being developed, and have continued with the approach as described in the SCSCI to the present. Section 3.5 of the SCSCI provides specific details of these harvest regimes. The Salmon Recovery Plan will provide a summary of progress to date. To fully understand the harvest management regimes established for recovery of summer chum salmon, the reader is encouraged to explore the SCSCI (WDFW and PNPTT 2000), subsequent supplemental reports (WDFW and PNPTT 2003) and progress reports (Adicks, et. al. 2004 and 2005).

4.2. Summary of the SCSCI Conclusions

Harvest management provisions have been developed by the co-managers to manage fisheries in a manner that will allow the rebuilding and maintenance of self-sustaining summer chum populations throughout Hood Canal and eastern Strait of Juan de Fuca. This effort also attempts to maximize harvest opportunities on co-mingled salmon species (WDFW and PNPTT 2000). The harvest management strategy utilizes a conservative four-way control mechanism:

- A base set of conservative fishing regulations,
- Abundance and escapement thresholds that trigger adjustments to the fishing regime,
- Exploitation rate[20] objectives that will result in changes to the harvest regime if not met, and
- Overall stock assessment criteria that will affect all plan provisions, including harvest, if not satisfactorily met at periodic plan reviews.

These regimes were established to counter the historical impacts from fisheries prior to the year 2000. SCSCI sections 2.2.5 and 3.5.3 provide detailed descriptions of the history of summer chum salmon fisheries (WDFW and PNPTT 2000). WDFW and PNPTT (2000) conclude that increased exploitation rates on Hood Canal and the Strait of Juan de Fuca summer chum stocks corresponded with the stocks declined. In the case of Hood Canal summer chum salmon, the added impacts of indirect harvests[21] in the terminal area[22] fisheries (after 1974) combined with a relatively consistent level of pre-terminal[23] catch. These contributed substantially to the decline and subsequent continuing low escapement levels.

Two different types of harvest have contributed to the decline of summer chum salmon of the region: preterminal fisheries in the Strait of Juan de Fuca, and terminal fisheries in Hood Canal. For Hood Canal summer chum stocks, pre-terminal harvests occur annually, primarily in fisheries for pink and sockeye salmon in the Strait of Juan de Fuca. After 1974, an added level of fishery exploitation began to occur in the terminal area, resulting in high exploitation rates through the 1980s. Terminal harvest has been rated as a major impact on Hood Canal summer chum salmon. For Strait of Juan de Fuca summer chum stocks, historical pre-terminal harvests were rated as having a moderate impact. Exploitation rates have increased substantially in preterminal fisheries in the 1980's, corresponding with the 1989 drop in summer chum salmon escapements to the region's streams (WDFW and PNPTT 2000). Past terminal harvest was considered a low impact during the period of decline.

The fact that these summer chum salmon stocks are at the southern limit of summer spawning chum salmon (when compared with all summer spawning

[20] "Exploitation rate" is the proportion of the returning run or the total population of summer chum salmon that is taken (harvested) by fisheries. "Harvest rate" is the proportion of the available numbers of summer chum salmon that is taken by fisheries in a specific time period and location.
[21] "Indirect harvests" are harvest that occurs on summer chum salmon during the conduct of fisheries for other stocks such as Chinook or coho salmon fisheries.
[22] "Terminal area" fisheries are fisheries that occur in the close vicinity or area of where the salmon were produced. For example, the harvest inside Hood Canal would be considered a "terminal area" harvest. A fishery that occurs in Quilcene Bay and the Quilcene River would be considered an "extreme terminal area" harvest.
[23] "Pre-terminal" catch or harvest would be fisheries of Hood Canal summer chum salmon that occur outside of Hood Canal or the eastern Strait of Juan de Fuca such as in Canadian fisheries.

chum salmon from Alaska to Puget Sound) may mean that they have a naturally lower level of productivity, making them less able than wild fall chum stocks to be successful with past estimated levels of exploitation rates. Eastern Strait of Juan de Fuca summer chum salmon declined abruptly in 1989. That was the same year that the Canadian pre-terminal exploitation rate peaked at 43.1%. Canadian pre-terminal exploitation rates, in the following three years averaged 24.1%, ranging from 18.3% to 33.3%. These were substantially higher than average. These higher exploitation rates likely contributed to the lowered escapements of summer chum salmon in the streams of Discovery and Sequim Bays after 1988 (WDFW and PNPTT 2000). Estimated exploitation rates on the associated summer chum salmon populations are provided in Table 4.1.

Table 4.1. Mean observed exploitation rates (%) on the summer chum salmon stocks of concern during selected time periods (modified from WDFW and PNPTT 2003 and Adicks, et. al. 2004 and 2005).

Populations	1974-1979	1980-1991	2000-2004
Salmon/Snow	11.9	21.2	0.5
Jimmycomelately	9.4	21.2	0.5
Quilcene	29.7	89.8	17.5
Dosewallips	25.1	48	1.2
Duckabush	25.1	48	1.2
Hamma Hamma	25.1	48	1.2
Lilliwaup	25.1	48	1.2
Union	58.9	54.9	1.2

4.3. Connections to Habitat

Although harvest is thought to have been a factor, in the historical decline of summer chum in Hood Canal and the Strait of Juan de Fuca, it should not be viewed in isolation of the other factors for decline. The synergistic effects of a potentially (though unknown) dramatically reduced productivity, and high harvest rates, may have resulted in reduced abundance. That reduced abundance has been observed, and warranted a listing of “threatened” under the ESA.

Abundance declined beginning in 1979. That decline could have been a result of low productivity. That low productivity was caused, in part, by increased winter flows. Those flows affected incubating eggs. Additionally, increased exploitation rates, in both terminal and pre-terminal areas, began in 1977 (WDFW and PNPTT 2000). As productivity improved in the early 1980s, the sustained increase in harvest rates may have hindered the ability of the populations to rebuild. Productivity again declined, with the significant decrease in mean spawning flows (September-October), beginning in 1986. The decrease in the mean spawning flows at this time is attributed to changing climatic patterns. This

decline, beginning in 1986, corresponded with the period of highest total exploitation (harvest) rates and lowest abundances in the summer chum ESU region from1989 to 1992. Increases in exploitation rates during this time were primarily due to increased exploitation in Canadian fisheries. Both U.S. pre-terminal and terminal fishery exploitation rates had begun to decline from their peaks in the early to mid-1980s. The combined affects of high preterminal exploitation rates and unfavorable spawning conditions may have also impeded recovery (WDFW and PNPTT 2000).

Although there may be summer chum caught in fisheries targeted on fall chum salmon, the harvest is probably very low given that the difference in peak entry timing between summer and fall chum varies by a month or more. In addition, GSI sampling of commercial fall chum fisheries in Hood Canal and South Puget Sound indicates that Hood Canal summer chum are not present at detectable levels during fall chum fisheries (WDFW and PNPTT 2000). Another theory for a contributor to the decline of summer chum has been predation and competition from both fall chum and other species. Both the numbers and timing of wild and hatchery-produced chum fry entering Hood Canal in recent years, and the indirect effects of overlapping spawning areas between the two races, suggest the possibility of negative competitive impacts on summer chum salmon populations. Hatchery programs for other species of salmonids have, in some cases, been intensive. And, the potential for both competitive and predatory impacts on summer chum salmon juveniles has been identified (WDF et al. 1993, Johnson et al. 1997, Tynan 1998). Although the evidence is not conclusive, the recent improvements in summer chum abundance suggest that these have not been significant contributors to the decline of summer chum. However, what competitive and predation effects do exist may aggravate declines in freshwater productivity in those systems already impacted by the climatic regime shifts and habitat degradation (WDFW and PNPTT 2000).

The reduction of stream and estuarine productivity and capacity, caused by habitat degradation, is cumulative with the negative effects of climate and excessive fishery exploitation. The affects of habitat degradation likely contributed to the decline in productivity, in systems with summer chum impacted by the regime shifts in 1976 and 1986 (WDFW and PNPTT 2000). Some summer chum salmon populations appear to have responded positively from the reduction in harvest rates and added supplementation (see section 5). This Salmon Recovery Plan (SRP), however, suggests that improved habitat conditions, coupled with a variety of other management actions described herein, will be essential to the ability of summer chum to recover.

4.4. Progress to date

Given that there is a current lack of reliable information on which to base estimates of appropriate escapement ranges or exploitation rates, interim management objectives have been defined while extensive monitoring programs

have been implemented to gather the necessary data. These harvest management objectives seek to minimize incidental impacts to summer chum, during fisheries for other species. The harvest strategy is known as the Base Conservation Regime (BCR). Harvest activities, conducted in accordance with this regime, are expected limit fishing mortality to a rate that permits a high proportion of the summer chum run to escapement, contributing to the rebuilding of self-sustaining populations. Designing generic fishery regimes, for the harvest of target species (coho, chinook, pinks, fall chum), is based on both the biological requirements of summer chum, and the target species. This is expected to result in stable, reduced exploitation rates on co-mingled summer chum salmon, when fisheries for those target species occur. When additional fishery restrictions are implemented to protect those target species, it is expected to also result in further protection for summer chum by further reducing incidental mortalities (WDFW and PNPTT 2000).

According to WDFW and PNPTT (2000), the BCR[24] is comprised of a conservative four-way control mechanism:

- A base set of fishery-specific management actions for fisheries in pre-terminal (Canadian, U.S.), Washington terminal and Washington extreme terminal areas;

- Management unit and stock abundance and escapement thresholds that trigger review and possible adjustment of the management actions;

- Expected fishery-specific exploitation rate targets and ranges based on the application of the BCR on the summer chum management units; and

- Overall management performance standards are based on natural production against which to assess success of the regime and make necessary adjustments. The actions required depend both on the status of the management unit and the stocks within them, with the most conservative controls prevailing.

The intent of the BCR is to initiate rebuilding, by providing incremental increases in escapement over time, while providing a limited opportunity for fisheries conducted for the harvest of other species. The BCR has been constructed using a conservative approach. It will pass-through to spawning escapement, on average, in excess of 95% of the Hood Canal-Strait of Juan de Fuca summer chum abundance in U.S. waters. It will also pass-through nearly 90% of the total abundance of the run (Adicks, et. al. 2005). The BCR is based on a conservative integration of the existing data and management experience. However, the plan is designed to be responsive to feedback mechanisms, in order to provide for

[24] Details of the BCR and harvest management regimes are provided in WDFW and PNPTT (2000), section 3.5.6.1 of the SCSCI.

adaptive management towards meeting the goals of protection of summer chum, while maintaining harvest opportunities (WDFW and PNPTT 2000). It is further noted that there is a commitment from the co-managers to implement additional fishery restrictions should it be determined that critical thresholds are not being met (WDFW and PNPTT 2000). It is the intent of the co-managers to develop a harvest regime in addition to the BCR that would be implemented when the ESU is recovered. Such a regime would provide greater management flexibility and expanded fishing opportunities.

The co-managers delineated management units to facilitate accounting of harvest and escapement throughout the summer chum ESU geographic area. Management units are made up of one or more stocks. Those stocks are aggregated in recognition of practical and biological limitations to available data, and how fisheries can be effectively managed (Adicks, et. al. 2005).

Estimated exploitation rates, for fisheries in Canadian and U.S. waters (both pre-terminal and terminal fisheries) that impacted summer chum salmon during the years 2001-04 (since the implementation of the SCSCI), were well below the target exploitation rates, as determined by the co-managers as part of the BCR. The SRP concludes that the harvest management regime established for Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon is working according to expectations and contributes to recovery of the species.

4.5. Monitoring the harvest management regime

The co-managers have developed and implemented specific, integrated monitoring programs that are designed to assist in improving stock assessment methodologies as well as effectiveness of harvest management actions and objectives (WDFW and PNPTT 2000). These programs include:

- consistent escapement monitoring methods;
- identification and quantification of harvest contributions;
- assessment of survival rates to recruitment by age; and
- assessment of stock productivity and productive capacity.

Escapement and harvest monitoring form the core elements that are critical to implementation of the harvest management regimes, particularly during the initial phase. The third and fourth programs are necessary to provide information that allows managers to tailor harvest, supplementation, and habitat planning guidelines and actions, as necessary, to determine, with acceptable accuracy, the necessary steps, time horizon and likelihood of restoration. The fourth monitoring provision will also allow managers to better define survival parameters, thus allowing to better define recovery; what can be sustained over the long-term, and how to maximize benefits by stabilizing the summer chum salmon resource. This information will also be essential to the integration and effectiveness of habitat and harvest management strategies by keying production

to current estimates of habitat capacity and productivity. WDFW and PNPTT (2000) provides the details of the escapement and harvest-monitoring program in section 3.5.10 of the SCSCI. Tasks described in the SCSCI include spawning ground surveys, sampling of fisheries in Canada and the U.S., and genetic stock identification, sampling and analyses.

As more information is collected and becomes available, harvest management strategies will be coordinated with habitat and hatchery strategies. The intent is to incrementally increase abundance and spawning escapements above recovered levels. By maintaining high escapement rates, additional fish from supplemented or natural production can take advantage of additional capacity or improved habitat. This approach appears to be working given the increasing numbers of natural origin fish showing on the spawning grounds in recent years. More details of the monitoring and adaptive management aspects of the SRP can be found in section 14. Recovery goals for each stock were developed in 2003, and the co-managers are in the process of determining how to incorporate the recovery goals into the management structure. In addition, fishery performance criteria will be revised to include the new information as appropriate. As reintroduction programs are implemented, and become effective, fishery performance criteria will be expanded. They will include the additional management targets, if it is found that the current targets are insufficient to provide the necessary protection (WDFW and PNPTT 2000).

4.6. Conclusions

The National Marine Fisheries Service (NMFS) must review harvest management plans for consistency with the ESA 4(d) rule for limitation of take prohibitions. The 4(d) rule (July 10, 2000, 65 FR 42422) (Limit 6) states that fishery harvest or artificial propagation activities, described in a Resource Management Plan (RMP) developed under *U.S. v. Washington* or *U.S. v. Oregon,* are not subject to take prohibitions under Section 9 of the Endangered Species Act, provided that they are conducted in accordance with an RMP that meets the criteria of the 4(d) rule (see http://www.nwr.noaa.gov/4d/limit6/rmpfinal.htm). The Washington Department of Fish and Wildlife (WDFW) and Point-No-Point Treaty Tribes (Co-managers), pursuant to their authorities under U.S. v Washington, provided a joint Resource Management Plan (RMP) for salmon fisheries. That plan will affect listed Hood Canal summer chum salmon. The harvest component of the document titled "Summer Chum Salmon Conservation Initiative - An Implementation Plan to Recover Summer Chum Salmon in the Hood Canal and Strait of Juan de Fuca" (SCSCI) is the RMP. NMFS has determined that, “implementing and enforcing the RMP will not appreciably reduce the likelihood of survival and recovery of the Hood Canal summer-run chum salmon Evolutionarily Significant Unit (ESU).”

The stated goal of the summer chum salmon RMP is to "...protect, restore and enhance the productivity, production and diversity of Hood Canal summer chum

salmon and their ecosystem to provide surplus production sufficient to allow future directed and incidental harvest of summer chum salmon." On a regular basis, NMFS will evaluate the effectiveness of the RMP in protecting and achieving a level of productivity commensurate with conservation of the listed salmon. If the plan is not effective, NMFS will identify, to the jurisdiction, ways in which the joint plan needs to be altered or strengthened. If the responsible agency does not make changes to respond adequately to the new information, NMFS will publish notification in the Federal Register announcing its intention to withdraw the limit on activities associated with that joint plan. Such an announcement will provide for a comment period of no less than 30 days. After that, NMFS will make a final determination whether to withdraw the limit so that take prohibitions would then apply to the harvest activities described in the joint plan (Federal Register 2001b). More information regarding the RMP and NMFS determinations can be founds at:
http://www.nwr.noaa.gov/4d/limit6/qa_HCRMP.htm

This SRP concludes that the co-managers harvest management regimes are designed to protect and provide for the recovery of summer chum salmon. These regimes are well established and have been implemented since the year 2000. At this time, no further actions are necessary regarding summer chum salmon harvest management, except to continue the prescribed monitoring and in-season adjustments as described in the SCSCI (WDFW and PNPTT 2000), subsequent supplemental reports (WDFW and PNPTT 2003), and annual progress reports (Adicks, et. al. 2004 and 2005). The current SRP attempts to address habitat protection and restoration through the identification of the habitat factors responsible for the decline of summer chum salmon and the implementation of recovery actions that will address the limiting factors. The SRP provides the forum for all of he H's--habitat, harvest, and hatchery--to be discussed as a part of the recovery of Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon. As aspects of harvest management are analyzed and integrated with aspects of hatcheries/supplementation (see section 5) and habitat restoration and protection; adaptive management will allow the opportunity to address all aspects/programs that contribute to recovery (see section 14).